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Contributions to the Mesozoic flora of the Atlantic coastal plain—I

EDWARD WILBER BERRY

(WITH PLATES 7–9)

While the present paper by no means exhausts the floral wealth of the Magothy formation, particularly within the state of Maryland, it is deemed advisable to publish it at this time in order to illustrate the remarkable floral unity of the formation, from which practically no plant-remains have hitherto been described outside the state of New Jersey. Such publication is especially necessary for the reason that while the name Magothy was proposed for these beds some years ago by Darton * it was not recognized by other geologists until republished by W. B. Clark in 1904,† its components having been previously referred to the underlying Raritan formation or to the overlying Matawan formation.

The plants are enumerated in their botanical order and include forms from the following localities: Cliffwood bluff on Raritan bay, New Jersey; the pits of the Cliffwood Brick Company near the head of Whale creek, New Jersey; near Morgan on Cheesequake creek, New Jersey; Kinkora on the Delaware river, below Trenton, New Jersey; the "Deep Cut" of the Chesapeake & Delaware canal just east of the Maryland line in Delaware; and Grove Point on the eastern shore of Chesapeake bay in Cecil county, Maryland. One or two species are included from the outcrop of the same formation on Good Hope Hill just across the Anacostia river at Washington, D. C.

The synonymy is omitted from all of the well-known but much-named species, and forms previously reported are not included in this contribution unless their range is extended.

PTERIDOPHYTA

GLEICHENIA SAUNDERSII Berry, Am. Nat. 37: 679. *f. 1–3.* 1903.

Described originally from Cliffwood bluff; a single specimen showing a trifle more than two centimeters of a single pinnule occurs in the material from Kinkora, N. J.

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* DARTON, Am. Jour. Sci. III. 45: 407–419. 1893.

† CLARK, *Ibid.* IV. 18: 435–440. 1904.

GLEICHENIA ZIPPEI Heer, Fl. Foss. Arct. **1**: *79. pl. 43. f. 4.* 1868.

This species, commonly accredited with the wide range from the Neocomian through the Senonian, has been recorded recently from several Cenomanian and Senonian localities in southeastern Europe. In all probability the early and late Cretaceous forms are distinct.

In addition to Cliffwood bluff, N. J., it occurs at Deep Cut, Del.

Osmunda delawarensis sp. nov. PLATE 8, FIGURES 2–4.

Fronds pinnate; pinnae simple, alternate, long, linear-lanceolate, inequilateral at the base; borders undulate, very slightly crenulate; frond substance thick. Pinnae 7.5 cm. long, 5–6 mm. wide near the base, tapering to a long narrow point, closely resembling the sterile pinnae of *Osmunda Presliana* J. Sm. of the east and south Asiatic region, except that the latter has a narrowed base, while this species has a large base more like that in *Osmunda regalis* L.

Whether the larger specimen figured is a pinnule of a bipinnate form like the modern cosmopolitan "royal fern" it is impossible to judge from the material thus far collected.

The *Osmundaceae* are rather common and widespread in the Jurassic, represented by *Todites*, etc. Various species have been referred to *Osmunda* or *Osmundites*, including two or three forms from the lower Potomac described by Fontaine, and showing supposed fructification. Penhallow has described in detail the structure of a stem from the lower Cretaceous of Queen Charlotte Islands under the name of *Osmundites skidegatensis*, which proves beyond question the occurrence of this type of plant at this general horizon.

Without the fertile parts we cannot, of course, be positive in our identification of this form, which is quite abundant at the Deep Cut of the C. & D. canal in western Delaware.

Osmunda at the present time contains six or seven species of swamp-loving ferns, most of them confined to the northern hemisphere, where they are wide-ranging. Three of these forms occur in North America.

SPERMATOPHYTA

CONIFERALES

SEQUOIA HETEROPHYLLA Velen. Gymnosp. Böhm. Kreidef. 22. *pl. 12. f. 2–4, 6–9; pl. 13. f. 12.* 1885.

Described originally from the Cenomanian of Bohemia, this species proves to be very abundant in the mid-cretaceous of the Atlantic coastal plain, with a known range from about the latitude of New York around the southern end of the Appalachian axis to Alabama.

Recorded in abundance from the Magothy formation at the pits of the Cliffwood Brick Co., N. J., Deep Cut, Del., and Grove Point, Md.

SEQUOIA GRACILLIMA (Lesq.) Newb. Fl. Amboy Clays 50. *pl. 9 f. 1–3.* 1896.

The cones of this species, which are so common on the beach at Cliffwood bluff, N. J., have been found during the past summer at Kinkora, N. J., on the Delaware river below Trenton, and at Deep Cut, Del.

SEQUOIA REICHENBACHI (Gein.) Heer, Fl. Foss. Arct. **1**: 83. 1868.

This widespread and probably composite species has been found during the past season in the pits of the Cliffwood Brick Co., N. J., and at Deep Cut, Del.

CUNNINGHAMITES SQUAMOSUS Heer, Kreidefl. v. Quedlinb. 9. *pl. 1. f. 5–7.* 1872.

In addition to the type locality in the Senonian of Saxony, this species has been found to be one of the most abundant forms characterizing the Magothy formation, occurring at Morgan, Cliffwood bluff, and Cliffwood Brick Co., N. J., and Deep Cut, Del.

Several specimens from Morgan and Deep Cut show the spreading sparse-leaved forms, larger specimens of which from the Judith river beds have been described by Knowlton as a new species.

MORICONIA CYCLOTOXON Deb. & Ett. Urwelt. Acrobry. Aachen 59. *pl. 7. f. 23–27.* 1859.

In 1859 Debey and Ettingshausen described this species from the Senonian of Aachen in Rhenish Prussia.[*] They considered it as possibly a fern of unknown affinities ("Plantae incertae sedis, filicibus affines") but could find nothing in the existing or fossil floras of the globe which matched it in venation, and they remark on its resemblance to such conifers as *Thuja*, *Thujopsis*, and *Libocedrus*.

The Swedish arctic expedition of 1870–1872 collected the same plant at Kudliset on Disco Island, and Professor Heer described it as a new species of *Pecopteris* (*P. kudlisetensis*).[†]

Both the Prussian and Greenland specimens were poorly preserved; subsequent collections, however, contained better material which was elaborated by Prof. Heer, who recognized the true identity of the specimens, placing them in the *Cupressineae* because of their resemblance to *Libocedrus*.[‡]

He corresponded with Dr. Debey to make sure of his identification, but the latter refused to admit their gymnospermous character, maintaining that certain discoid fungi which were found on some of the specimens were sori which thus established their filicean nature.

The next we hear of this species is in abundant remains from the upper Raritan clays at South Amboy, N. J., which Dr. Newberry during a European trip in 1888 compared with some of Debey's specimens. In his flora of the Amboy Clays numerous fine specimens are figured[§] and it is worth mentioning that the abundant and more representative collections from the lower horizons in the Raritan do not show any trace of this species which is so common at South Amboy.

In 1898 Dr. Hollick records specimens from Block Island and from Staten Island.[||]

The writer has collected this species in considerable abundance, but in a rather fragmentary condition, from the Cretaceous clays near Cliffwood, N. J.* These specimens are remarkable in being about one hundred per cent. more robust than any of the former that have been figured, and invariably have the main stem covered with the usual leaves, which are wanting on the stem in most of the Greenland specimens.

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[*] DEBEY & ETTINGSHAUSEN, Die Urweltlichen Acrobryen des Kreidegebirges von Aachen etc. Denkschr. Wien. Akad. **17**: 239 (59). *pl. 8. f. 23–27.* 1859 (presented Nov. 12th, 1857).

[†] HEER, Kongl. Svenska Vetenskaps-Akad. Handl. **12**: 97. *pl. 26. f. 18.* 9 O 1873.—Fl. Foss. Arct. **3^2**: 97. *pl. 26. f. 18.* 1874.

[‡] HEER, Fl. Foss. Arct. **6^2**: 49. *pl. 33. f. 1–9.* 1882; **7**: 11. *pl. 53. f. 10.* 1883.

[§] NEWBERRY, Mon. U. S. Geol. Surv. **26**: 55. *pl. 10. f. 11–21.* 1896.

[||] HOLLICK, Ann. N. Y. Acad. Sci. **11**: 57, 418. *pl. 3. f. 10; pl. 37. f. 8.* 1898.

Recently the writer found several characteristic specimens of this species in the Deep Cut of the Delaware & Chesapeake canal just inside the Delaware state line, thus extending the known range one hundred miles southwest from Cliffwood, N. J. The writer has also collected it recently at Grove Point on Chesapeake Bay some eighteen miles further along the strike from Deep Cut.

So many of the mid-Cretaceous forms that are common in the coastal plain flora extended around its then southern border (Tuscaloosa formation of Alabama) that it would seem as if a careful search would reveal this species as well.

With regard to the botanical affinities of this plant, its gymnospermous nature has been commonly accepted of late years, and I cannot say that I know of any valid arguments against such affinity. It seems strange, in view of the abundant remains at South Amboy and Cliffwood, that no fruits have ever been found associated with the twigs, or in a position to suggest such an association. Another anomaly is the delicate texture of some of the specimens; for instance, from Grove Point, Maryland, I have a good-sized specimen which is of the thinnest consistency, suggesting a lax thallophyte, and yet showing in detail the characteristic markings of this species, which once seen are unmistakable.

FRENELOPSIS GRACILIS Newb. Fl. Amboy Clays 59. *pl. 12. f. 1–3a.* 1896.

This species was described by Newberry from Woodbridge, N. J., and does not show an organism whose botanical relations we can be at all certain about. Some of my Maryland material, originally included under *Widdringtonites Reichii* (Ett.) Heer, is identical with Newberry's species, both probably representing the decorticated twigs of the latter which is so common in these formations.

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* BERRY, Bull. N. Y. Bot. Gard. 3: 65. *pl. 43. f. 4; pl. 48. f. 1.* 1903.—Bull. Torrey Club 31: 70. 1904.

Hollick (Bull. N. Y. Bot. Gard. 3: 411. 1904) has reached the same conclusion, or at least suggested the same origin, for *Frenelopsis Hoheneggeri*, and the evidence seems probable enough in the case of my specimens. The *Frenelopsis* predominates at Deep Cut, Delaware, and the *Widdringtonites* predominates at Grove Point, Maryland. The Portuguese representative is *Frenelopsis leptoclada* Sap.

BRACHYPHYLLUM MACROCARPUM Newb. Fl. Amboy Clays 51 (footnote). 1896. PLATE 9.

Magnificent specimens of this species occur in the pits of the Cliffwood Brick Co., N. J., and at Deep Cut, Del. They are especially common at the latter locality.

Hollick and Jeffrey, from a study of the wood, recently announced the probable affinity of this species with the *Araucariineae*, and the publication of their investigation will be looked forward to with a great deal of interest.

JUNIPERUS HYPNOIDES Heer, Fl. Foss. Arct. 6^2: 47. *pl. 44. f. 3; pl. 46. f. 18.* 1882.

In washing out and picking over the lignite masses from the pits of the Cliffwood Brick Company, at which point the lignite consists of an assortment of leaves, sticks, seeds, and scales, not greatly macerated and but slightly solidified, among an abundant display of the twigs of *Sequoia Reichenbachii* (Gein.) Heer, were found perhaps a dozen fragments of twigs of a very graceful and delicate conifer which I refer to *Juniperus hypnoides* Heer.

I was at first disposed to refer these specimens to *Sequoia gracillima* (Lesq.) Newb., but further consideration has convinced me that they are identical with the twigs which Heer refers to *Juniperus*. Newberry refers somewhat similar remains, from the Raritan formation at Woodbridge, N. J., to *Juniperus macilenta* Heer. The figure which he gives is not very distinct and all that can be made out from it is that it represents a short-leaved graceful conifer. The Cliffwood material is certainly distinct from the type material of *Juniperus macilenta* Heer, which has more open and much less robust leaves than *J. hypnoides*. Also very common in the sandy clays at the Deep Cut of the C. & D. canal, Delaware.

THUJA CRETACEA (Heer) Newb. Fl. Amboy Clays 53. *pl. 10. f. 1, 1a.* 1896.

This species occurs in the Magothy formation at Grove Point, Md., and at Deep Cut, Del., and is excessively common at the latter locality.

WIDDRINGTONITES REICHII (Ett.) Heer, Fl. Foss. Arct. 6^2: 51. *pl. 28. f. 5.* 1882.

A very common species in the Atlantic coastal plain ranging from Greenland and Martha's Vineyard to Alabama. The new localities are Morgan, N. J., Deep Cut, Del., Grove Point and Overlook Inn road on Good Hope Hill in the District of Columbia. All of these localities are in the Magothy formation.

Picea cliffwoodensis sp. nov.

A remarkably well-preserved cone of *Picea* was collected at Cliffwood bluff and scales of apparently the same species occur in the lignite at the pits of the Cliffwood Brick Company. The principal specimen is pyritized and slightly flattened and is 8 cm. long with the apical portion missing, so that the cone in life was 10–12 cm. in length and very similar to the modern European *Picea excelsa* (Lam.) Link. Scales thin, persistent, somewhat kite-shaped, broadest across the middle and obtusely pointed, the two contained seeds rather large. Clearly referable to *Picea* and much more definite in its relations than other spruce-like fossil cones variously described as *Pinus*, *Pinites*, etc.

This species will be fully described and figured in the Report of the State Geologist of New Jersey for 1905.

GRAMINALES

CAREX CLARKII Berry, Am. Nat. **39**: 345. *f. 1.* 1905.

This species of sedge, originally collected by Dr. W. B. Clark on Grove Point, Maryland, has continued to come to light from other localities, and is a characteristic element in the flora of the Magothy formation. The remains are usually fragmentary and to that extent unsatisfactory. To the previously enumerated localities of Morgan and Cliffwood bluff, N. J., Deep Cut, Del. and Grove Point, Md., may be added Kinkora, N. J.

ARECALES

FLABELLARIA MAGOTHIENSIS Berry, Torreya **5**: 32. *f. 1, 2.* 1905.

This species was described from material collected in Delaware and Maryland, so that great interest attaches to the finding of the same form, and in considerable abundance, in the pits of the Cliffwood Brick Company in New Jersey. It thus serves to characterize the Magothy formation. The material is poor, but characteristic. The largest fragments secured are 17 cm. long and 8 cm. wide.

JUGLANDALES

JUGLANS ARCTICA Heer, Fl. Foss Arct. 6^2: 71. *pl. 40. f. 2; pl. 41. f. 4c; pl. 42. f. 1–3; pl. 43. f. 3.* 1882.

Heer figures a number of leaves of this species which show considerable range in size, and he includes under this name a nut which is undoubtedly referable to *Juglans*, as well as the remains of aments. His *pl. 40. f. 2* shows a much larger leaf than the rest of his specimens, doubtfully related to *Juglans* in my opinion, and looking more like the leaf of some species of *Magnolia*. With the balance of his figures our leaf agrees very well, as it does with Newberry's leaf from Woodbridge, N. J.,* and Lesquereux's leaves from Kansas.† Hollick's leaf from Long Island ‡ is a basal fragment of a much larger leaf and his Block Island reference is based upon an ament.

In some of the Dakota group leaves the secondaries are somewhat more ascending than in our specimen, but it seems to me that there can be no question as to their identity.

A rather curious point of identity is the fact that the Greenland, New Jersey and Kansas leaves are all inequilateral, additional proof, if that were necessary, that they appertain to *Juglans*. From the pits of the Cliffwood Brick Co., N. J.

MYRICALES

MYRICA LONGA (Heer) Lesq. Fl. Dakota Group 67. *pl. 3. f. 1–6.* 1892.

The Dakota group and Staten Island leaves are smaller than this leaf from Grove Point, Md., while the Arctic leaves vary considerably in size, some being larger and some smaller than the Maryland leaf, which agrees with them closely, however, in both outline and venation.

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* NEWBERRY, Fl. Amboy Clays *pl. 20. f. 2.* 1896.

† LESQUEREUX, Fl. Dak. Group *pl. 19. f. 3; pl. 39. f. 5.* 1892.

‡ HOLLICK, Bull. Torrey Club **21**: *pl. 178. f. 2.* 1894.

SALICALES

SALIX FLEXUOSA Newb. Later Extinct Floras 21. 1868; U. S. Geol. Surv. Mon. **35**: 56. *pl. 2. f. 5; pl. 13. f. 3, 4; pl. 14. f. 1.* 1898.

Salix proteaefolia flexuosa Lesq. Fl. Dak. Group 50. *pl. 64. f. 4, 5.* 1892. — Berry, Bull. N. Y. Bot. Gard. **3**: 67. *pl. 48. f. 12; pl. 52. f. 2.* 1903.

This small, narrow, elongate-leaved willow which Lesquereux regarded as a variety of his species *Salix proteaefolia* is very common in the Cretaceous of the Atlantic coastal plain and is particularly abundant and widespread in the Magothy formation as far as it has been explored in New Jersey, Delaware and Maryland. The forms are here restored to specific rank, as they are obviously distinct from *Salix proteaefolia* when the latter is correctly characterized. As I have discussed these forms at length in the Report of the State Geologist of New Jersey for 1905, they will not be farther considered in this place. Found in the Magothy formation at Cliffwood bluff, Cliffwood Brick Company and Morgan, New Jersey; Deep Cut, Delaware; and Grove Point, Maryland.

SALIX PROTEAEFOLIA Lesq. Am. Jour. Sci. **46**: 94. 1868. — Report on N. J. Clays 29. 1878. — Cret. Fl. 60. *pl. 5. f. 1–4.* 1874. — Cret. and Tert. Fl. 42. *pl. 1. f. 14–16; pl. 16. f. 3.* 1883. — Fl. Dakota Group 49. 1893. — Newb. Fl. Amboy Clays 66. *pl. 18. f. 3, 4.* 1896. PLATE 7, FIGURE 2.

Salix proteaefolia longifolia Lesq. Fl. Dakota Group 50. *pl. 64. f. 9.* 1893.

It is unnecessary to comment upon the forms included under this species, which are shown by the foregoing synonymy.

It occurs in the Magothy formation at the pits of the Cliffwood Brick Co., N. J., Deep Cut, Del., and Grove Point, Md.; PLATE 7, FIGURE 2 being a somewhat misleading representation in so far as the venation is shown of a specimen from the latter locality.

POPULUS (?) APICULATA Newb.; Hollick, Trans. N. Y. Acad. Sci. **12**: 4. *pl. 3. f. 2.* 1892. — Newb. Fl. Amboy Clays 65. *pl. 15. f. 3, 4.* 1896.

While I fully share Newberry's doubt as to this species being a *Populus*, I have no better suggestion to offer. Found in the Magothy formation at Deep Cut, Delaware.

URTICALES

FICUS ALIGERA Lesq. Fl. Dak. Group 84. *pl. 10. f. 3–6.* 1892.

These small oval entire leaves with winged petioles and stout midribs are rather small for this genus. The leaf-substance is thick and the venation is immersed. My collections contain several complete specimens from the pits of the Cliffwood Brick Company which do not differ from Lesquereux's type figures except that they do not show the secondary venation.

FICUS KRAUSIANA Heer, Fl. v. Moletein 15. *pl. 5. f. 3–6.* 1869.

Several characteristic fragments of this species occur in the thin layers of Magothy clay, just beneath the Matawan contact at Grove Point, Md.

FICUS WOOLSONI Newb.; Hollick, Trans. N. Y. Acad. Sci. **12**: 33. *pl. 2. f. 1, 2c.* 1892.

This rather anomalous leaf I take to be an abnormal one of this species, which is so common in the coastal plain Cretaceous. It is an especially common and variable species in the New Jersey Raritan, but has also been collected from Cliffwood bluff.

The leaf before us is ovate with truncate base and pointed apex, triple-veined. A sharp sinus divides one half of the leaf into two nearly equal rounded lobes, which give it the appearance of certain leaves from the Cenomanian of Bohemia which Velenovsky has described * as *Crotonophyllum cretaceum*, the resemblance being especially close to his figures *7* and *11* of that species.

FICUS CRASSIPES Heer, Fl. Foss. Arct. **6**^{2}: 70. *pl. 17. f. 9a; pl. 24. f. 1, 2.* 1882.

Found in the Magothy formation at Deep Cut, Del., and Grove Point, Md.

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* VELENOVSKY, Květena českého cenomanu 20. *pl. 5. f. 4–8, 10, 11.* 1889.

FICUS DAPHNOGENOIDES (Heer) Berry, Bull. Torrey Club **32**: 329. *pl. 21.* 1905. PLATE 1, FIGURE 5.

This species is a common element in the Magothy formation at Deep Cut, Del., and Grove Point, Md., as it is from other localities in the coastal plain.

PROTEALES

PERSOONIA LESQUEREUXII Knowlt. Fl. Dak. Group 89. *pl. 20. f. 10–12.* 1892.

This small rounded leaf, narrowed and somewhat produced basally, occurs in the material from the pits of the Cliffwood Brick Co., N. J. It is entirely characteristic of this species.

RANALES

NELUMBO KEMPII Hollick, Bull. N. Y. Bot. Garden **3**: 412. *pl. 74. f. 1, 2; pl. 75; pl. 76; pl. 77. f. 1.* 1904.

This species of *Nelumbo*, originally considered as related to the palms, is relatively abundant in the Cretaceous of Long Island, but has not been found elsewhere heretofore. The leaves vary greatly in size, so that I have no hesitation in referring the leaves from Morgan, N. J., to this species, although the veins are not so prominent as those of the type material are said to be. My specimens, while somewhat fragmentary, are perfectly characteristic, and denote a leaf about 16 cm. in diameter. There are sixteen rather thin radiating veins, and the remains of the thick petiole is shown pressed close against the under side of the leaf. The specimen figured shows the upper surface of the leaf and there are faint indications of secondary venation. It is quite probable that the primaries would appear considerably more prominent from the under surface were that exposed. The only other fossil *Nelumbo* from the coastal plain is *Nelumbo primaeva* Berry, from the exposure on the beach near Cliffwood, N. J., and this species I am inclined to consider as simply a young leaf of *Nelumbo Kempii*. As Hollick (*loc. cit.*) remarks, *Nelumbo Kempii* is very similar if not identical with *Nelumbium arcticum* Heer from the homotaxial Atane beds of Greenland. My specimen differs from this as well as from Hollick's material, as aforesaid, in its thinner venation. In this character the leaf from Morgan, N. J., is comparable with

Nelumbium Lakesianum and *N. tenuifolium* of Lesquereux from the Denver and Laramie respectively.

I am of the opinion, however, that this difference in venation is almost entirely dependent upon the size of the leaves.

We have in these Long Island and New Jersey specimens the earliest known record of the genus, in species whose leaves are practically indistinguishable from those of the living *Nelumbo lutea.*

MAGNOLIA AURICULATA Newb.; Hollick, Bull. Torrey Club **21**: 61. *pl. 179. f. 6, 7.* 1894.

This species is rather common in the Magothy formation at Grove Point, Md.

MAGNOLIA TENUIFOLIA Lesq. Am. Jour. Sci. **46**: 100. 1868.

PLATE 7, FIGURE 1.

Additional material more complete than that figured occurs in the Magothy formation at Deep Cut, Delaware.

Liriodendron morganensis sp. nov.

Length along the midrib 7 cm., breadth across the lower lobes 9 to 10 cm. Apical sinus deeply and broadly rounded. Lobes stout and bluntly rounded, the lower directed laterally. Midrib and petiole very stout.

Several perfect specimens were collected from the Magothy formation at Morgan, N. J., and they will be fully described and illustrated in the Report of the State Geologist of New Jersey for 1905.

CARPITES LIRIOPHYLLI Lesq. Cret. & Tert. Fl. 77. *pl. 11. f. 5.* 1883.

Unmistakable remains of this species, which was originally described from Morrison, Colorado, occur at Deep Cut, Del. They undoubtedly represent the fruit-remains of some contemporary species of *Liriodendron.*

ROSALES

Platanus Kümmelii sp. nov.

Leaves large, palmately trilobate when mature, triple-veined from the base which is cuneate and entire. Margin sharply and widely serrate. Main sinuses deep and rather narrow for this genus, rounded. Petiole, midrib and lateral primaries stout. Secondaries nearly straight. Tertiary venation characteristically platanoid.

Length about 19 cm. Breadth 21 cm. These leaves are very common in the pits of the Cliffwood Brick Company, occurring both in the clays and in the lignites. With them are found abundant remains of the fruit ("button-balls"). This species will be more fully described and figured in the Report of the State Geologist of New Jersey for 1905.

Colutea obovata sp. nov. PLATE 8, FIGURES 5, 6.

Obovate, almost orbicular in general outline, inequilateral, with rounded lobes and a rather deep and broadly rounded sinus. 2.5 cm. long and about the same breadth, the broadest part being toward the apex, the lower part of the blade being wedge-shaped with curved margins. Midrib curved, rather stout; secondaries four or five on each side, sub-opposite, thin, ascending, camptodrome, leaving the midrib at an angle of about 45°. Tertiary venation very fine, but distinctly shown.

Type specimens consist of one perfect leaf and its somewhat broken counterpart from Grove Point, Maryland.

I was at first disposed to refer this handsome little leaf to *Colutea primordialis* Heer, which is so widely distributed in the American Mid-Cretaceous, but careful comparison renders such reference impossible. While the Grove Point leaf is somewhat of the same proportions as the leaf from the Dakota Group which Lesquereux refers to *C. primordialis*, still it is broader and more retuse and has fewer secondaries. In fact a comparison of Lesquereux's leaves with the type figures renders it doubtful if the Dakota Group leaves are identical with the other leaves that have been referred to this species by Heer, Newberry and Hollick. Comparing our leaf with Heer's type figures we note that the latter are larger, proportionally longer, narrower and with less rounded lobes. The Raritan leaves of Newberry are entirely dissimilar in outline and venation and are very angular looking. Hollick's leaf from the Long Island Cretaceous is rather different from Newberry's leaves, but is still less retuse and spreading than our Maryland leaf. Among the other Cretaceous species of *Colutea*, *C. Langeana* Heer is long and narrow, *C. coronilloides* Heer is narrow and has a pointed apex, *C. protogaea* Heer from Patoot shows two types of form, his *pl. 61. f. 1c* is broadest across the middle of the blade and has a restricted sinus, while his *pl. 62. f. 1c* has a narrow sinus and an angular outline like the leaves which Newberry refers to *C. primordialis.* Probably the most similar to our species among those of the Cretaceous is *Colutea valde-inaequalis* Heer, from Greenland, which in its general proportions is quite similar, but it is a somewhat larger leaf and has the sinus sharp instead of widely rounded.

Comparing our leaf with the various Tertiary species, it may be noted that the only American species (*C. Boweniana* Lesq.) is entirely different. With the forms from the European Tertiary, however, there is more similarity, the nearest being *Colutea macrophylla* Heer (*cf.* Fl. Tert. Helv. **3**: *pl. 132. f. 46*), while the venation of all the Swiss Miocene species (*C. Salteri*, *C. macrophylla*, *C. debilis*, and *C. antiqua*) is very close to that of the American leaf.

HYMENAEA DAKOTANA Lesq. Fl. Dakota Group 145. *pl. 55. f. 2, 3; pl. 56. f. 1, 2; pl. 62. f. 2.* 1892.

Fontaine has referred to this genus a species from the Potomac formation of Virginia, based upon the basal fragments of leaflets. It is perhaps needless to say that very little confidence can be placed in this determination. Undoubted species do occur, however, during the Mid-Cretaceous, Velenovsky having described three forms from the Cenomanian of Bohemia and Lesquereux the above species from the Dakota Group. The latter usually occurs as detached inequilateral leaflets with a rather stout curved midrib. Two of these leaflets occur in the collections from Morgan, N. J. They are somewhat smaller than the other leaves referred to this species, that of Hollick * and some of Lesquereux's being considerably larger. Judging from the figures Hollick's leaf is probably referable to the species *Phaseolites manhassettensis* recently established (Bull. N. Y. Bot. Gard. **3**: 414. *pl. 78. f. 1, 2.* 1904) by him for the reception of certain leaves from Manhasset Neck, Long Island.

Newberry's leaf (Fl. Amboy Clays 90. *pl. 41. f. 14.* 1896) and Lesquereux's *fig. 3* are identical in outline with the Morgan leaf, which appears to have been of a very delicate texture and does not show any venation characters, due undoubtedly to the rather sandy matrix. A single perfect specimen from the pits of the Cliffwood Brick Co. is larger than the Morgan leaf and shows the long ascending camptodrome secondaries.

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* HOLLICK, Bull. Torrey Club **21**: *pl. 176. f. 4.* 1894.

SAPINDALES

ILEX STRANGULATA Lesq. Ann. Rep. U. S. Geol. and Geog. Surv. Terr. **1874**: 359. *pl.* 7. *f.* 8. 1876.

While this leaf is not so "strangulate" as the type, it is exactly similar in all other respects. It has the same coriaceous texture, thick petiole and midrib, and the same secondary venation, particularly the marginal vein. From the pits of the Cliffwood Brick Co., N. J.

RHAMNALES

Paliurus populiferus sp. nov.

Leaf orbicular, slightly emarginate at the apex and with a decurrent base. Three-veined from the top of the petiole, which is 0.94 cm. in length. Leaf 2.5 cm. long and 3.25 cm. wide.

Found at the pits of the Cliffwood Brick Co., N. J., and will be figured in the Report of the State Geologist of New Jersey for 1905.

CISSITES CRISPUS Velen. Fl. Böhm. Kreidef. **4**: 12 (73). *pl.* 4 (27). *f.* 6. 1885 (1887).

Doubtful specimens of this species occur at the pits of the Cliffwood Brick Co., N. J., and in iron carbonate nodules at Deep Cut, Del.

MALVALES

GREWIOPSIS FLABELLATA (Lesq.) Knowlt. Bull. U. S. Geol. Surv. **152**: 114. 1898.

Poorly represented in the material from the Magothy formation at Grove Point, Md.

Sterculia minima sp. nov.

"*Sterculia mucronata* Lesq."; Berry, Bull. N. Y. Bot. Gard. **3**: 90. *pl.* 43. *f.* 3. 1903.

Small 2- or 3-lobed, subcoriaceous leaves, ranging in length from 4–6 cm. Lobes narrow, pointed, ascending at an angle of somewhat less than 45°, with narrow sinuses extending about half way to the base. Lateral primaries branching from the midrib above its base and secondary venation camptodrome, but not well shown in most specimens.

Because of the well-known variability in fossil *Sterculia* leaves both from this country and abroad, the original two-lobed specimen from Cliffwood bluff was referred to Lesquereux's species cited above, and was considered to be a small bilobed form of the same species, which ordinarily bore rather larger leaves. Subsequent collections, however, at different localities far removed from Cliffwood bluff, show that these small leaves are uniform in size and may be indifferently two or three lobed, so that it seems desirable to consider them distinct from the ordinarily much larger *Sterculia mucronata* Lesq. of the west, from which it may be distinguished by its much smaller size, its less conical lobes, directed upwards instead of laterally, and the fact that in the former the leaves are palmately 3–5-lobed and the primaries are three in number and are palmately arranged from the top of the petiole.

Formation—Magothy.

Localities—Cliffwood bluff (type) and pits of Cliffwood Brick Company, N. J., Deep Cut, Del., and Grove Point, Md.

STERCULIA CLIFFWOODENSIS Berry, Bull. N. Y. Bot. Gard. **3**: 88. *pl. 43. f. 5.* 1903.

Originally described from Cliffwood bluff, N. J. A single broken fragment from Deep Cut, Del., has one lobe preserved for a distance of 10 cm., which must have given the perfect leaf much the appearance of *Sterculia lugubris* Lesq.

THYMELEALES

LAURUS HOLLICKII Berry, Bull. N. Y. Bot. Gard. **3**: *79. pl. 52. f. 4.* 1903.

This is one of the commonest species in the Magothy formation, to which it is confined, and has been collected at Morgan and Cliffwood bluff, N. J., at Deep Cut, Del., and at Grove Point, Md.

LAURUS PLUTONIA Heer, Fl. Foss. Arct. 6^2: 75. *pl. 19. f. 1d, 2-4,* et seq. 1882.

This widespread mid-Cretaceous species has been found at the following localities in the Magothy formation: Morgan, Cliffwood bluff and Cliffwood Brick Co., N. J., and Grove Point, Md.

LAUROPHYLLUM ANGUSTIFOLIUM Newb. Fl. Amboy Clays 86. *pl. 17. f. 10, 11.* 1896.

Found in the Magothy formation at Cliffwood bluff, N. J., and at Grove Point, Md.

CINNAMOMUM INTERMEDIUM Newb. Fl. Amboy Clays 89. *pl. 29. f. 1–8, 10.* 1896. PLATE 7. FIGURES 3, 4.

This species ranges from New Jersey to Alabama. It is very common at the pits of the Cliffwood Brick Company in the former state and is also found at Deep Cut, Del., and Grove Point, Md. Velenovsky identifies a leaf which is very close to this species from the Cenomanian of Bohemia, where it is widely distributed, as *Aralia daphnophyllum.*[*]

Attention is directed to the similarity which all of these leaves show to the entire forms of the modern *Sassafras.*

CINNAMOMUM HEERII Lesq. Am. Jour. Sci. **27**: 361. 1859. — Trans. Am. Phil. Soc. **13**: 431. *pl. 23. f. 12.* 1869. — Cret. Fl. 84. *pl. 28. f. 11.* 1874. — Cook's Clay Report 28, 29. 1878. — Cret. & Tert. Fl. 54. 1883. — Fl. Dak. Group 105. *pl. 15. f. 1.* 1892. — Newb. Fl. Amboy Clays 28, 29. 1896 (?). — U. S. Geol. Surv. Mon. **35**: 100. *pl. 17. f. 1–3.* 1898. — Knowlton, Ann. Rep. U. S. Geol. Surv. **21^7**: 318. 1901. — ? Kurtz, Revista Mus. La Plata **10**: 52. 1902.

Daphnogene Heerii Lesq. Ann. Rep. U. S. Geol. & Geog. Surv. Terr. **1874**: 343. 1876.

From the number of fragments at the pits of the Cliffwood Brick Co., I judge this species to have been rather common, although much search has failed to reveal complete specimens. One of these shows a leaf of abnormal lateral growth, the midrib being abruptly bent almost at a right angle just above the point of insertion of the lateral primaries. This species differs from the typical form such as is figured in the Flora of the Dakota Group by its slightly more ovate outline and the wide angle which the lateral primaries make with the midrib. It may be distinguished from *Cinnamomum intermedium* Newb., which is common at this locality, by its thicker texture, shorter form, wider and more rounded base, and thicker veins, the latter being comparatively thin in *C. intermedium.* I have included Newberry's reference under this species although I am not absolutely certain that his forms are identical with those of Lesquereux.

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[*] Fl. böhm Kreidef. 1: 23. *pl. 5. f. 5–8, 10; pl. 6. f. 1–5.* 1882.

The Raritan localities enumerated by Lesquereux in Cook's Clay Report are very doubtful.

Kurtz records (*loc. cit.*) this species from the Cenomanian of Cerro Guido, Argentina, but his paper, unfortunately, is not illustrated. In view of the variety of triple-veined Lauraceous leaves still existing in the warmer parts of South America, his reference of such a leaf to this North American species seems to me to be very doubtful.

MALAPOENNA FALCIFOLIA (Lesq.) Knowlton, U. S. Geol. Surv. Bull. **152**: 142. 1898.

Litsea falcifolia Lesq. Fl. Dak. Group 97. *pl. 11. f. 5.* 1892.

Described originally from the Dakota Group of Kansas, a single specimen has thus far come to light in the collections from the pits of the Cliffwood Brick Co.

UMBELLALES

HEDERA CRETACEA Lesq. Fl. Dak. Group 127. *pl. 18. f. 1.* 1892.

A single specimen which I have correlated with this species occurs in the collections from Deep Cut, Delaware.

MYRTALES

EUCALYPTUS WARDIANA Berry, Bull. Torrey Club **32**: 47. 1905.

Characteristic remains of this species, described from Cliffwood bluff, N. J., have been found in the pits of the Cliffwood Brick Co. in that state and at Deep Cut, Del., and Grove Point, Md.

EUCALYPTUS GEINITZI Heer, Fl. Foss. Arct. **6**^{2}: 93. *pl. 46. f. 12, 13.* 1882.

This species which was found to be common at Cliffwood bluff, N. J., shows remarkably perfect and characteristic specimens from Deep Cut, Delaware.

EUCALYPTUS (?) ATTENUATA Newb. Fl. Amboy Clays 111. *pl. 16. f. 2, 3, 5.* 1896.

Found in the Magothy formation at Cliffwood bluff, N. J., and Grove Point, Md.

ERICALES

ANDROMEDA NOVAE-CAESAREAE Hollick, in Newb. Fl. Amboy Clays 121. *pl. 42. f. 9–12, 28–31.* 1896.

I have four specimens of this well marked small leaf from Grove Point, two of which are perfect. They are identical with Hollick's figures from New Jersey, representing a broadly lanceolate leaf, equally pointed at both ends, with ascending curved secondaries.

ANDROMEDA PARLATORII Heer, Phyll. Crét. Nebr. 18. *pl. 1. 5.* 1866.

This well-known and widespread Cretaceous species was found at Deep Cut, Del., and Grove Point, Md.

EBENALES

DIOSPYROS ROTUNDIFOLIA Lesq. Cret. Fl. 89. *pl. 30. f. 1, 1a.* 1874.

Our leaves agree with Hollick's specimens from Long Island and with the numerous examples from Kansas figured in the Flora of the Dakota group, which are somewhat smaller than the type.

This is a common form in the pits of the Cliffwood Brick Company, N. J., at Deep Cut, Del., and at Grove Point, Md., thus becoming a characteristic species of the Magothy formation.

Sapotacites Knowltoni sp. nov. PLATE 8, FIGURE 1.

Sapotacites sp.? Lesq. Fl. Dak. Group 114. *pl. 65. f. 3.* 1892.

An oval leaf, 5.5 to 6 cm. long, round-emarginate at the apex, with full rounded margins to the base. Secondaries ascending, camptodrone, their angle of separation rather acute. This is obviously identical with the leaf figured by Lesquereux from the Dakota Group. It is about the same size as *Sapotacites retusus* Heer as it occurs in the Raritan formation, but is considerably less emarginate and is broadest across the middle and not toward the base. The basal margins are convex and not concave and the secondaries are more ascending.

This species, of which several specimens have been collected at Deep Cut, Del., is very close to *Sapotacites obovata* Velen.,* from the Cenomanian of Bohemia, the latter being somewhat larger, and narrower toward the base.

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* Fl. böhm. Kreidef. 3 : 3. *pl. 3. f. 6.* 1884.

SANTALALES

Santalum Novae-Caesareae sp. nov.

Leaf oblong, about 10 cm. long and 2 cm. in greatest width. Blade gradually narrowed to the stout petiole. Tip broadly rounded and midrib stout. Secondaries leaving the midrib at an acute angle, long and ascending, finally becoming camptodrone, showing a tendency to become massed toward the base.

From Morgan and Cliffwood Brick Co., N. J.

Santalum has not hitherto been recognized in the Cretaceous of North America, and while these leaves are rather large for this genus, they appear to be identical with a number of living species of *Santalum*, notably *Santalum cognatum*, *S. ellipticum*, etc.

Material will be more fully described and illustrated in the Report of the State Geologist of New Jersey for 1905.

MARYLAND GEOLOGICAL SURVEY.

Explanation of plates 7-9

PLATE 7

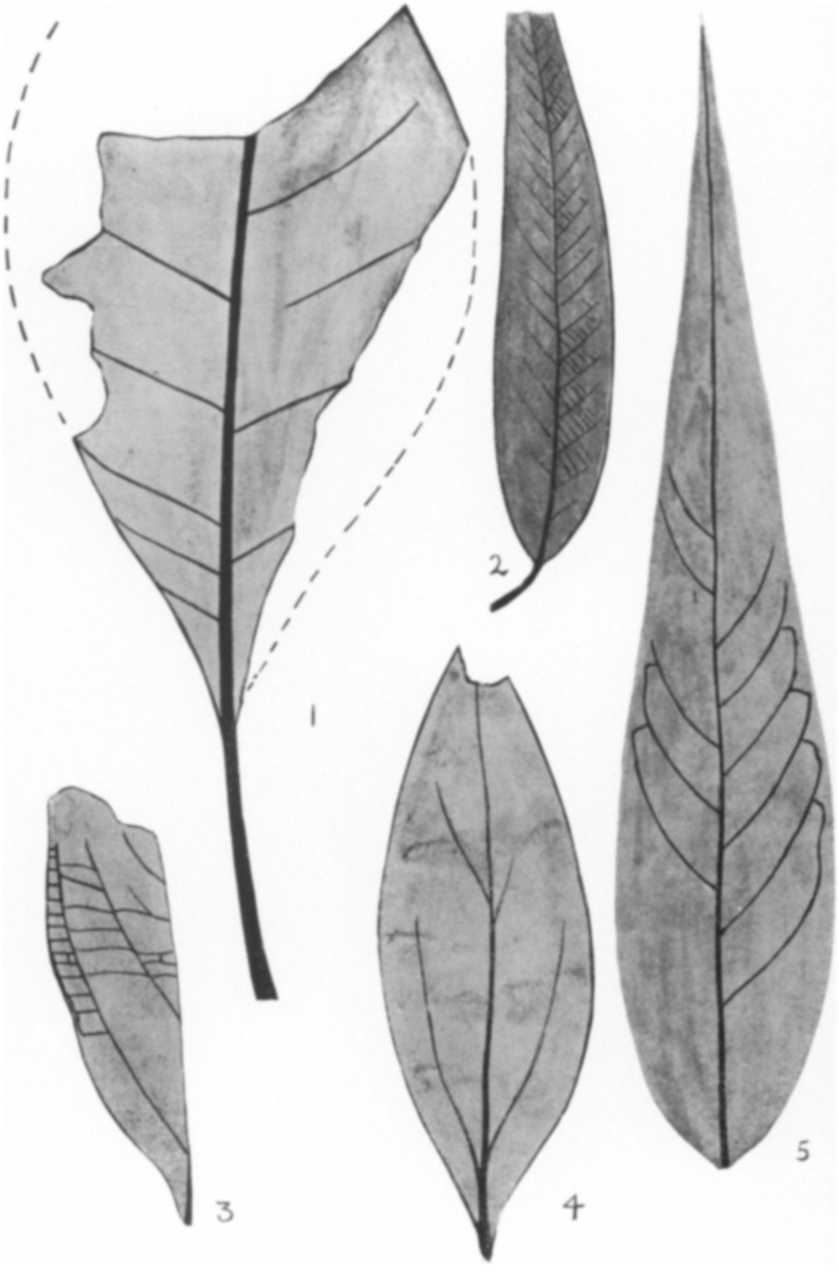
FIG. 1. *Magnolia tenuifolia* Lesq., from Deep Cut, Del.
FIG. 2. *Salix proteaefolia* Lesq., from Grove Point, Md.
FIG. 3. *Cinnamomum intermedium* Newb., from Deep Cut, Del.
FIG. 4. The same, from Grove Point, Md.
FIG. 5. *Ficus daphnogenoides* (Heer) Berry, from Grove Point, Md.

PLATE 8

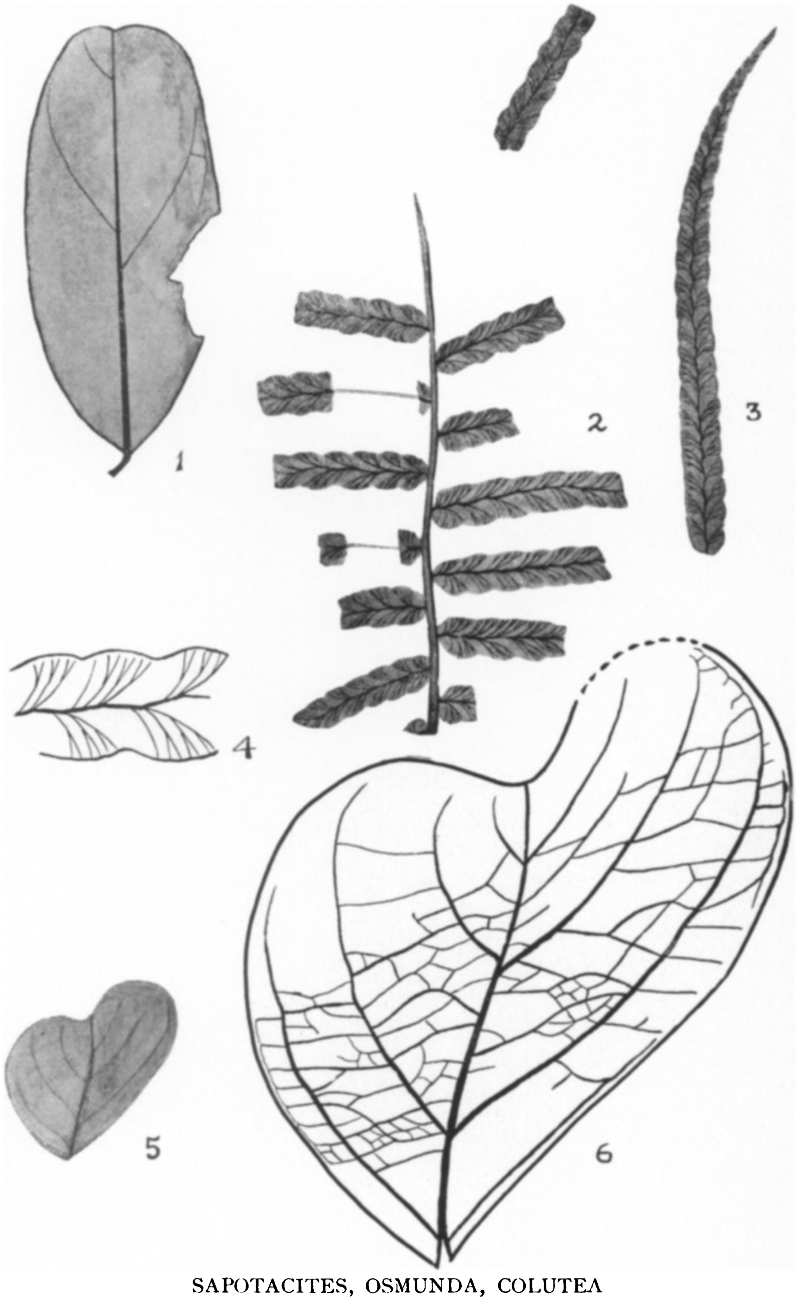
FIG. 1. *Sapotacites Knowltoni* Berry, from Deep Cut, Del.
FIG. 2, 3, 4. *Osmunda delawarensis* Berry, from Deep Cut, Del.
FIG. 5, 6. *Colutea obovata* Berry, from Grove Point, Md.

PLATE 9

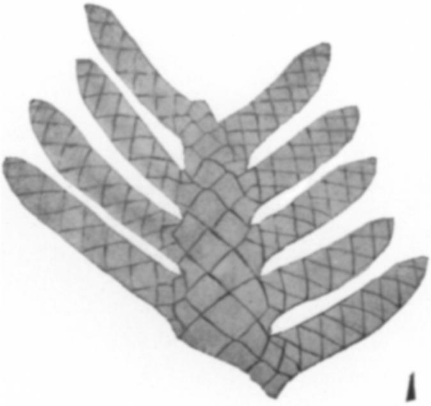
FIG. 1, 2. *Brachyphyllum macrocarpum* Newb., from Deep Cut, Del.
FIG. 3. The same, from the pits of the Cliffwood Brick Co., N. J.



MAGNOLIA, SALIX, CINNAMOMUM, FICUS



SAPOTACITES, OSMUNDA, COLUTEA



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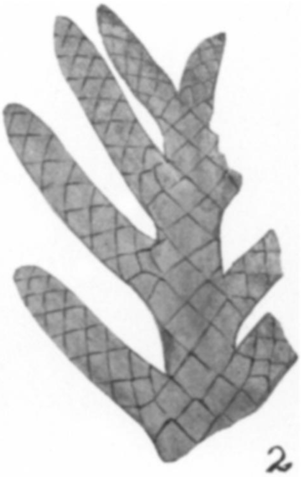

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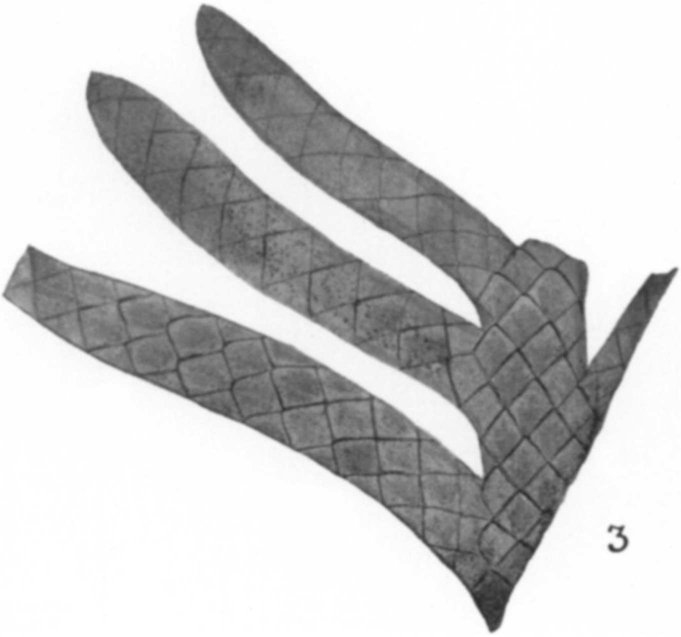

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BRACHYPHYLLUM